FINAL REPORT

2015 Direct Observation Survey of Child Restraint and Booster Seat Use and Misuse

Prepared for:
Office of Highway Safety Planning
333 South Grand Avenue
P.O. Box 30634
Lansing, MI 48909

Prepared by:
Wayne State University
Transportation Research Group
Detroit, MI 48202

September 8, 2015

MICHIGAN
OHSP
Office of Highway Safety Planning

WAYNE STATE UNIVERSITY
COLLEGE OF ENGINEERING

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16. Abstract

This study reports the results of the 2015 statewide direct observation survey of child restraint device (including booster seats) use and misuse in Michigan. Child restraint device (CRD) use rates were determined through a direct observation survey conducted at daycare centers, fast food restaurants, shopping centers, and recreational areas throughout Michigan, as well as the adjacent streets to each selected location. The direct observation survey, conducted between May and July of 2015, showed statewide child restraint use rates of 95.7 percent among 0 to 3 year-old children and 49.7 percent among 4 to 7 year-olds. The most prominent driver-related determinant of CRD or booster seat use among child passengers was driver safety belt use, as the CRD use was significantly lower when the driver was not belted appropriately. CRD misuse rates were determined through on-site inspections conducted at daycares, festivals or other events, health care centers, inspections stations, and shopping centers. The statewide inspections found that only 26.0 percent of the CRDs were correctly utilized, which is consistent with prior inspections in Michigan. The most common seat-related misuse was the improper positioning of the harness retainer clip (typically too low), which was observed in nearly 57 percent of the rear-facing seats and 47 percent of the forward-facing seats. It was also determined that nearly 47 percent of 1-year old children were prematurely seated in a forward-facing CRD, which is generally not recommended to occur until the age of 2. Similarly, 18 percent of 3-year old children were prematurely seated in a booster seat. Excessive recline (from vertical) was also a common misuse for rear-facing seats, as parents often do not properly increase the seat incline when the child is able to lift his/her head, typically by age 6-months. Improper harness routing below the shoulders was a common problem for forward-facing seats, which is likely a carry-over from prior rear-facing utilization of the particular seat. Excessive slack (greater than 1-inch) in the harness strap remains a common misuse for both rear- and forward-facing seats, although these rates have declined substantially from prior inspections. Loose CRD attachment to the vehicle seat, while still common in rear-facing seats, was much improved from prior inspections for both rear- and forward-facing seats. Consistent with prior inspection surveys in Michigan, misuses of rear-facing seats presented a greater severity risk than forward-facing seats.

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1.0 INTRODUCTION

Motor vehicle crashes are one of the leading causes of death and injury for children under 8 years of age. From 2010 to 2014, a total of 52,774 child passengers under the age of 8 were involved in 39,344 traffic crashes in Michigan [*1*]. Among those child-aged vehicle occupants for whom restraint use information was recorded, only 35,695 (67.6 percent) were restrained in some type of child specific restraint, either a child restraint device or a belt-positioning booster seat. Amongst these children restrained in some type of child safety seat, 191 (0.4 percent) suffered fatal (K) or incapacitating (A) injuries [*1*]. Prior research confirms the appropriate use of child restraint devices (CRDs) and booster seats can greatly reduce the risk of serious injury to children involved in traffic crashes. The risk of serious injury for children between 12 and 47 months of age is 78 percent lower for children seated in forward-facing CRDs than for children restrained in safety belts alone [*2*]. Similarly, the risk of injury for children between ages 4 and 7 is reduced by 59 percent when the proper CRD is used and the risk of head or brain injuries is reduced by 75 percent [*3*].

Over the prior two decades, Michigan has experienced increases in the use of CRDs among children under 4 years of age from 74.5 percent in 1997 to 93.6 percent in 2013 [*4-7*]. In spite of these gains, about half (45 percent) of the children under the age of 4 who were killed in traffic crashes in Michigan from 2010 to 2014 were improperly or completely unrestrained [*1*]. Although non-restraint of a child passenger presents obvious safety implications, many of the children killed in these crashes may also have been improperly restrained within a functional CRD.

The improper use of CRDs may expose a child to a heightened risk of injury when involved in a crash. CRDs are most effective when: (1) the devices are appropriate for the age, height, and weight of the child being restrained, (2) the devices are properly and securely installed in the vehicle using seatbelts or a Lower Anchors and Tethers for Children (LATCH) restraint system, and (3) the child is properly and securely restrained in the device. Recent studies by the Wayne State University Transportation Research Group (WSU-TRG) have shown roughly 70 to 80 percent of CRDs in Michigan are improperly used to some degree [*4-7*]. The most recent CRD study performed by the WSU-TRG in 2013 found that the most common CRD misuses were (1) improper seat recline (rear-facing seats only), (2) too muck slack in the harness straps and (3) improper positioning of the harness retainer clip [*7*]. This is concerning as improper seat recline and loose harnesses have been identified in previous research as one of the most severe forms of misuse [*8,9*]. Other severe CRD misuses include: internal harness not buckled, not buckling the seatbelt or attaching the LATCH anchor, improper routing of the seatbelt when restraining the CRD to the vehicle seat, shoulder harness straps too high (rear-facing only), and excessive space between the CRD and the vehicle seat [*8,9*]. Fortunately, the other severe misuses were found to occur relatively infrequently during the most recent CRD inspections performed for OHSP

While child restraint use has increased dramatically among children under the age of 4, restraint use among 4 to 7 year-olds has been shown to be substantially lower [*10*]. There are several potential explanations for the low booster seat use rate, including a lack of knowledge of the state law and best practice regarding the benefits of booster seats

compared to seat belts alone, in addition to differences in risk perception among parents [*11-17*]. Following the enactment of statewide legislation in July 2008, booster seat use was found to increase substantially in Michigan [*18,19*]. However, the most recent survey (2013) found greater than half (57.6 percent) of 4 to 7 year-old child passengers continue to travel while inappropriately restrained [*7*].

2.0 STUDY OBJECTIVES

The purpose of this study was to determine the rates of child restraint device use and misuse among children passengers under the age of 8 in Michigan. The survey results provide valuable information regarding changes in child restraint use patterns throughout the state of Michigan as well as help to identify areas of opportunity for increasing the use of appropriate child restraint devices by Michigan drivers. Understanding the degree of nonuse and misuse will also assist in developing educational efforts, public awareness campaigns, and enforcement initiatives.

The proposed study built off of the methodologies from previous surveys, such as the 2009, 2010, 2011 and 2013 studies conducted by the WSU-TRG [*5,6,7,18,19*], in order to accurately and efficiently estimate the rates of use and misuse of CRDs and booster seats in the state of Michigan. Use rates were determined through a series of destination surveys conducted at locations subject to high volumes of target-age children. Misuse rates were based on visual and hands-on inspection of children under the age of 8 who were seated in a CRD. Each device was inspected for type of seat, location in the vehicle, direction of placement, attachment to the vehicle, and the placement and restraint of the child in the device. Such data may assist the Office of Highway Safety Planning in the development of public awareness messages specifically targeted to common or critical CRD/booster misuses.

3.0 METHODOLOGY

The study methodology essentially consists of two separate, but related, components. The first component involves direct observational surveys of CRD and booster seat use. This allows for a longitudinal comparison of use rates over time and provides data for use by the state of Michigan to develop targeted educational and public awareness programs to positively impact child safety. This portion of the study resulted in the determination of overall rates of CRD and booster seat use in Michigan.

The second component focuses on CRD and booster seat misuse and was based upon visual and hands-on inspections. The main objectives of this analysis were to determine both the rate and degree/severity of misuse, as well as to identify patterns of common and severe misuse of CRDs and booster seats.

The study methodology is similar to prior surveys, utilizing a destination-based sampling strategy for both the surveys and inspections. This sampling scheme is based upon the methodology utilized during the 2009, 2011, and 2013 surveys and involves collecting data from a random sample of target age children at daycare centers, fast food restaurants, recreational sites, and shopping centers, as well as the street adjacent to each selected location.

3.1 Site Selection

In order to accurately determine rates of CRD and booster seat use and misuse, a representative sample of target-aged groups of children were required as a part of this study: (a) children from ages 0 to 4 and (b) children from ages 4 to 7. In order to ensure the representativeness of the sample, these observations were to be diverse in terms of geographic coverage, vehicle mix, and the socioeconomic characteristics of the drivers. To ensure such representativeness while maintaining data collection efficiency, sites were sampled from 23 counties representing nearly 82 percent of the target population (children ages 0 to 7). The counties were similar to those included in the 2009, 2010, 2011 and 2013 surveys [*5,6,7,18,19*]. The 2014 county census estimates for children ages 0 to 3, and children ages 4 to 7 are provided in Table 1 [*20*].

To provide similar levels of precision in comparison to previous studies, a target sample size of at least 3,000 children within each age group was established for the child restraint use survey while a target sample size of 300 children was established for the inspections of misuse.

The candidate counties were previously partitioned into four strata based upon historical safety belt use rates and vehicle miles traveled (VMT) as per the direct observation surveys of safety belt use. This stratification was based upon the fact that CRD and booster seat use have been shown to be related to the driver's safety belt use by previous studies [*5,6,7,18,19*]. Combining counties with similar use and/or misuse rates into strata reduces the within-stratum variability and allows for a reasonable number of observations within each stratum while ensuring desired levels of precision. Stratum 1 includes those counties with the highest historical restraint use rates while Stratum 4 has exhibited the lowest use rate. These counties were partitioned as shown in Table 2.

The specific observation sites were selected from a statewide sample of locations expected to yield high volumes of target-aged child passengers, including daycare centers, fast food restaurants, recreational sites (e.g., zoos, museums, parks, etc.), and shopping centers. To allow for a direct comparison between the results of these surveys and those conducted as a part of previous surveys, the same sites were utilized where feasible. Some of the observation sites from previous surveys had subsequently closed or were found to yield very low volumes of target-aged children. Such locations were replaced by alternate sites within the same county and these alternate sites were of the same type as the initial sites they replaced. Complete lists of locations used for the child restraint device use surveys are included by site type in Appendix I (Daycare Centers), and Appendix II (Fast Food Restaurants, Shopping Centers, and Recreational Sites).

Table 1. 2014 Michigan Population Estimates of Children Ages 0-3 and 4-7, by County

County	Population Ages 0 to 3	Percent of Statewide Population Ages 0 to 3	Population Ages 4 to 7	Percent of Statewide Population Ages 4 to 7
Allegan	5,374	1.2%	6,126	1.3%
Berrien	7,484	1.6%	7,549	1.6%
Calhoun	6,571	1.4%	6,883	1.5%
Eaton	4,628	1.0%	4,880	1.0%
Genesee	19,795	4.4%	20,557	4.3%
Grand Traverse	3,899	0.9%	4,112	0.9%
Ingham	13,040	2.9%	12,594	2.7%
Isabella	2,582	0.6%	2,772	0.6%
Jackson	7,007	1.5%	7,484	1.6%
Kalamazoo	12,322	2.7%	12,671	2.7%
Kent	35,538	7.8%	35,166	7.4%
Livingston	7,255	1.6%	8,420	1.8%
Macomb	37,022	8.1%	39,522	8.3%
Midland	3,415	0.8%	3,808	0.8%
Monroe	6,277	1.4%	6,979	1.5%
Muskegon	8,402	1.8%	8,982	1.9%
Oakland	54,251	11.9%	57,001	12.0%
Ottawa	13,897	3.1%	15,092	3.2%
Saginaw	9,012	2.0%	9,024	1.9%
St. Clair	6,443	1.4%	7,310	1.5%
Van Buren	3,809	0.8%	3,833	0.8%
Washtenaw	14,984	3.3%	15,124	3.2%
Wayne	91,996	20.2%	91,902	19.4%
Sample Total	**375,003**	**82.5%**	**387,791**	**81.9%**
Statewide Total	**454,412**	**100.0%**	**474,630**	**100.0%**

Site selection for the misuse inspections was largely based upon the methodology of the 2011 and 2013 studies [*6,7*]. In both studies, inspections were performed at daycare centers, permanent inspection stations, and various organized events, including those held at shopping centers, community or church festivals, or health care facilities. Several of the high-yield inspection sites from the 2011 and 2013 studies were again contacted to determine their willingness to participate in the 2015 study.

Table 2. Counties Utilized for Direct Observation Survey, by Stratum

Stratum 1	Stratum 2	Stratum 3	Stratum 4
Ingham	Allegan	Berrien	Macomb
Kalamazoo	Calhoun	Genesee	Wayne
Oakland	Eaton	Isabella	
Washtenaw	Grand Traverse	Muskegon	
	Jackson	Saginaw	
	Kent	St. Clair	
	Livingston	Van Buren	
	Midland		
	Monroe		
	Ottawa		

The county strata assignments for the inspections were identical to those used in the CRD direct observation surveys, although the minimum necessary sample size for the inspection of the restraint use characteristics of passengers under the age of 8 was much smaller due to the time and human resources necessary to perform the inspections. A list of all CRD inspection locations is provided in Appendix III.

3.2 Observer Training

Two targeted training programs specific to this project were conducted during the spring of 2015: (1) training for inspection of CRD/booster seat misuse; and (2) training for direct observation of CRD/booster seat use. All training occurred during early May of 2015. Classroom training for the inspections was conducted on May 6, 2015 by a NHTSA-certified Child Passenger Safety Technician Instructor. This training session included both classroom instruction and hands-on in-vehicle instruction on child safety restraint use and misuse. Each data collector received a training manual summarizing the information received during the training session. At the end of the training session, each data collector was required to successfully demonstrate inspections of actual CRD/booster seat installations prepared by the instructor. After the initial training, each new technician "shadowed" an experienced technician during his/her initial inspection event.

Classroom training for the direct observation survey of child restraint use was also conducted on May 6, 2015. During the classroom training, data collectors were provided with information to aid in assessing the age of child passengers, including height/weight information and sample photographs. At the conclusion of the training session, field personnel were tested on their ability to assess the age of child passengers based upon a series of photographs. The classroom training session was followed by practice field data collection at a local recreational location. The purpose of the field data collection was to provide observers with an opportunity to gain field experience in assessing child passenger age and determining the type of child restraint use. Observers worked as a group at the start of the field training, quickly followed by a mock session where they were instructed to record the information needed to the best of their ability. Following the field training, their performance was monitored to ensure consistency among observers. This included comparing the number of target-aged children identified by each observer, as well as the type of restraint used by each observed child. In addition to these training exercises, each data collector received a training manual, as well as all necessary field supplies.

3.3 Data Collection Procedures for Direct Observation Survey

During weekday surveys, the data collection schedule was arranged such that observations could be conducted at a fast food restaurant at the start of the day, followed by shopping center locations in route to a daycare center scheduled to be visited later the same day. Each daycare center was researched to determine start and release times, and other locations (e.g., shopping centers, fast food restaurants, recreation centers) were also researched to ensure they were still in operation. In order to minimize the travel time and distance required to conduct this study, the observation sites were clustered into geographic regions. Weekend data collection was performed at all types of locations, excluding daycare centers.

During the direct observation use surveys, several factors were assessed as a part of data collection. For all vehicles identified to have a 0 to 7 year-old child passenger, the driver and all target-age child passengers were observed for restraint use and non-use. A sample field observation form is shown in Figure 1.

Vehicles were observed at the entrance or exit of the observation site. At the primary observation sites where traffic volumes were relatively low, data were also collected from vehicles on the adjacent street. The vehicles were categorized into four groups: passenger vehicles, sport utility vehicles, vans/minivans, or pickup trucks. Driver restraint use, gender, age group, and ethnicity were assessed and recorded. Driver restraint use was categorized as belted, not belted, or unknown. An age assessment was required for each child passenger under age 8, in addition to the type of restraint and seating position within the vehicle. The seven restraint categories for each child were: belted, not belted, unknown, rear-facing child safety seat, front-facing child safety seat, high-back booster, or backless booster.

❑ SAME VEHICLE AS PREVIOUS ❑ OBSERVED ON ADJACENT STREET			
VEHICLE TYPE:			
❑ Passenger Car ❑ SUV ❑ Van/Minivan ❑ Pickup Truck			
DRIVER			
RESTRAINT USE:	**AGE:**	**GENDER:**	**RACE:**
❑ Belted	❑ 16-29	❑ Male	❑ White
❑ Not Belted	❑ 30-59	❑ Female	❑ Black
❑ Unknown	❑ 60+	❑ Unknown	❑ Other
	❑ Unknown		❑ Unkown

CHILD PASSENGER					
RESTRAINT USE:		**AGE:**	**SEATING POSITION:**		
❑ Belted	❑ Rear-Facing CSS	❑ Under 2			
❑ Not Belted	❑ Front-Facing CSS	❑ 2 to 3	D	❑	❑
❑ Unknown	❑ High-Back Booster	❑ 4 to 7	❑	❑	❑
	❑ Backless Booster		❑	❑	❑

Figure 1. Sample Data Collection Form

3.4 Data Collection Procedures for Misuse Inspections

A separate data collection effort included visual and hands-on inspection of the child restraint devices for children under the age of 8 at targeted locations. The same vehicle and driver data were collected as for the use rate survey. Data collected with respect to the child passengers were similar, but also included age, height, and weight information, either measured or reported by the adult driver or passenger. The vehicle year, make, and model were also noted. An initial assessment of the restraint type, location in the vehicle, direction of placement, attachment to the vehicle, and placement of the child in the device was made. LATCH availability and utilization were also noted.

Each child seated in a child restraint device or booster seat was inspected for several common misuses, as well as the degree or extent of each misuse. Particular attention was paid to the prevalence of severe misuse categories, including loose internal harness, internal harness not buckled, not buckling or adequately securing the seatbelt or attaching the LATCH anchor, improper routing of the seatbelt when restraining the CRD to the vehicle seat, shoulder harness straps routed incorrectly, and excessive space between the CRD and the vehicle seat. All observed restraint misuses were carefully recorded onto the data collection form along with descriptive notes. The complete inspection checklist is included in the inspection form, which is displayed in Appendix IV.

3.5 Data Analysis

Rates of appropriate child restraint use were determined at the statewide- and stratum-level, as well as with respect to each of the characteristics previously described. For the purposes of the direct observation survey, "appropriate" child restraint use was defined based on current Michigan law. Thus, children under the age of 4 that were seated in a rear-facing or forward-facing child safety seat were considered to be using the appropriate restraint. Premature graduation to a booster seat or safety belt was classified as inappropriate restraint use for this age group. Appropriate restraint use for children ages 4 through 7 included rear-facing restraint, forward-facing restraint, or booster seat (high back or backless). Premature graduation to safety belts (without a booster) was classified as inappropriate. The procedures used to calculate the appropriate use rates and their associated variances are outlined below.

3.5.1 Statewide Child Restraint Device Use Rate Calculations

In order to determine the statewide child restraint use (or misuse) rate, a procedure was utilized similar to previous studies [*4-7,18,19*]. This procedure is illustrated here with respect to the appropriate use rate calculation. First, the child restraint device use rate at each study location was calculated as shown here:

$$g_{ij} = \frac{b_{ij}}{o_{ij}}$$

where:

g_{ij} = use rate at location i in stratum j

b_{ij} = number of target age children restrained appropriately at location i in stratum j

o_{ij} = total number of target age children observed at location i in stratum j

Then, the child restraint device use rate within each stratum (r_j) was determined as follows:

$$r_j = \frac{\sum_j b_{ij}}{\sum_j o_{ij}}$$

Once the child restraint use rates were determined within each stratum, the statewide use rate was calculated using the following equation:

$$r_{TOTAL} = \frac{\sum_j (p_j r_j)}{\sum_j (p_j)}$$

where:

r_{TOTAL} = statewide child restraint device use rate

p_j = population of target age children in stratum j

The 'p' values in the preceding equation are weighting factors that are necessary because strata with higher populations of target age children will have a greater impact on the statewide use rate. Separate estimates were obtained for the 0 to 3, and 4 to 7 year-old age groups.

3.5.2 Statewide Child Restraint Device Use Variance Calculation

Upon obtaining estimates of the child restraint device use and misuse rates for each of the four strata, the variance for each stratum was determined using the following equation [*21*]:

$$Var_j \approx \frac{n_j}{n_j - 1} \sum_i \left(\frac{o_{ij}}{\sum_i o_{ij}} \right)^2 (g_{ij} - r_j)^2 + \frac{n_j}{N_j} \sum_i \left(\frac{o_{ij}}{\sum_i o_{ij}} \right)^2 \frac{(g_{ij} - r_j{}^2)^2}{g_i}$$

where:

Var_j = variance for stratum j

n_j = number of sampled observation locations in stratum j

N_j = number of available observation locations in stratum j

The second term in the above equation can be dropped from the equation with no significant impact on the resulting estimate, providing the following formula where all variables are as previously defined:

$$Var_j \approx \frac{n_j}{n_j - 1} \sum_i \left(\frac{o_{ij}}{\sum_i o_{ij}} \right)^2 (g_{ij} - r_j)^2$$

Given the variance of child restraint device use within each stratum, the statewide variance in use can then be calculated using the following formula:

$$Var_{TOTAL} = \frac{\sum_j (p_j^2 Var_j)}{(\sum_j p_j)^2}$$

where:

Var_{TOTAL} = statewide variance in child restraint device use

The calculated variances were used to construct 95-percent confidence intervals for the strata and statewide use rates using the following equation:

Strata-level $95\%Cl = r_j \pm 1.96\sqrt{Var_j}$

Statewide $95\%Cl = r_{TOTAL} \pm 1.96\sqrt{Var_{TOTAL}}$

3.5.3 Misuse Rate Determination

The CRD/booster misuse rates for each stratum and statewide were determined based on the data obtained from the inspections. Separate misuse rates were also computed for rear-facing CRDs, forward-facing CRDs, and booster seats. A CRD/booster was considered to be "misused" if one or more of the itemized misuse characteristics was observed during the inspection or if no CRD was utilized to restrain the child. The misuse rate was computed based on the number of inspected CRDs with one or more misuses divided by the total number of inspected CRDs. The overall statewide misuse rate was calculated by weighting the misuse rates for each of the three seat-type categories (rear-facing, forward-facing, and booster seat) based on seat use proportions obtained from the direct observation survey. The misuse rates were also compared with those obtained during prior inspections.

A severity score was also determined for both the forward-facing CRDs and rear-facing CRDs. The severity scores were similar to those used in a study conducted in Canada in 2002 [*8*], which were developed by CRD safety experts [*9*]. A severity score of '10' indicates a misuse of the highest severity and a severity score of '0' indicates the misuse has no safety impact. A severity score of '4' or higher will compromise the effect of the CRD on the child's safety during a crash [*8*]. The severity scores for each type of misuse were multiplied by the percent of occurrence. This resulted in a risk priority number for each type of misuse. The risk priority numbers were summed for all misuse types to determine the total risk priority number for both the forward-facing CRD and rear-facing CRD. The weighted average severity score per rear-facing and forward-facing CRD was also determined. The average risk priority numbers were compared with those observed in previous studies performed by the WSU-TRG. LATCH availability and utilization was also computed and compared to prior surveys.

4.0 DATA SUMMARY

4.1 Child Restraint Device Use

The statewide child restraint device use survey was performed between Saturday, May 9, 2015 and Wednesday, July 29, 2015. During this observation period, a total of 9,699 observations of 0 to 7 year-old child passengers were conducted at daycare centers, fast food restaurants, shopping centers, and recreation centers, as well as on streets adjacent to these locations throughout the 23-county sample. Summary statistics detailing the results of the child restraint use survey by stratum and site type are provided in Table 3.

Table 3. Summary of Observations by Stratum and Site Type

Stratum	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
Stratum 1	964	21.7%	927	17.6%
Stratum 2	1,337	30.1%	1,547	29.4%
Stratum 3	1,060	23.8%	1,339	25.5%
Stratum 4	1,084	24.4%	1,441	27.4%
Total	**4,445**	**100.0%**	**5,254**	**100.0%**
Site Type	**Number of Children 0-3 Years Old Observed**	**Percent of Total Sample**	**Number of Children 4-7 Years Old Observed**	**Percent of Total Sample**
Daycare	120	2.7%	194	3.7%
Recreation	248	5.6%	452	8.6%
Shopping Center	1,056	23.8%	1,134	21.6%
Fast Food	538	12.1%	606	11.5%
Adjacent Street	2,483	55.9%	2,868	54.6%
Total	**4,445**	**100.0%**	**5,254**	**100.00**

Table 4 provides details of the number of children observed by type of vehicle and seating position. Approximately half of the target-age children in each age category were in passenger cars, with lower percentages in sport utility vehicles, vans/minivans, and pickup trucks. Approximately 6.5 percent of 4 to 7 year-old children were observed in the first row of seating. While this is a slight decrease from 2013, this issue is problematic since these seating positions put children at a higher risk of injury due to issues such as airbag deployment. More encouragingly, only 0.5 percent of 0 to 3 year-old children were restrained in the front seat. This is a significant decrease from the 2013 study. The Centers for Disease Control and Prevention (CDC) and the American Academy of Pediatrics (AAP) recommend that children less than 13 years of age not be seated in the front seat if other alternatives are available.

Table 4. Summary of Observations by Vehicle Characteristics

Vehicle Type	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
Passenger Car	2,379	53.5%	2,677	51.0%
Sport Utility Vehicle	1,283	28.9%	1,432	27.3%
Van/Minivan	656	14.8%	843	16.0%
Pickup Truck	127	2.9%	302	5.7%
Total	**4,445**	**100.0%**	**5,254**	**100.0%**
Child Passenger Seating Position	**Number of Children 0-3 Years Old Observed**	**Percent of Total Sample**	**Number of Children 4-7 Years Old Observed**	**Percent of Total Sample**
First Row - Left	1	0.0%	1	0.0%
First Row - Center	4	0.1%	13	0.2%
First Row - Right	27	0.6%	327	6.2%
Second Row - Left	1,537	34.6%	1,813	34.5%
Second Row - Center	1,000	22.5%	635	12.1%
Second Row - Right	1,859	41.8%	2,399	45.7%
Third Row - Left	6	0.1%	23	0.4%
Third Row - Center	6	0.1%	10	0.2%
Third Row - Right	5	0.1%	33	0.6%
Total	**4,445**	**100.0%**	**5,254**	**100.0%**

Table 5 presents data on the number of children observed by various driver characteristics, including gender, age, race, and belt use. Overall, approximately 59.0 percent of children aged 0 to 3 years-old and 51.9 percent of children aged 4 to 7 years-old were riding with a female driver. The majority of children (61.1 percent) were traveling with a driver in the 30-to-59 year old age group and approximately 73.9 percent of the children observed were traveling with a Caucasian driver. Among 4 to 7 year-old children, 97.4 percent were traveling with a driver who was appropriately belted while 97.2 percent of 0 to 3 year-old children were traveling with an appropriately restrained driver. Comparison of these rates with recent statewide safety belt use rates (approximately 93 percent), suggests that drivers are more likely to be properly belted when traveling with child passengers

Table 5. Summary of Observations by Driver Characteristics

Driver Gender	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
Male	1,422	32.0%	1,772	33.7%
Female	2,624	59.0%	2,728	51.9%
Unknown	399	9.0%	754	14.4%
Total	**4,445**	**100.0%**	**5,254**	**100.0%**
Driver Age	**Number of Children 0-3 Years Old Observed**	**Percent of Total Sample**	**Number of Children 4-7 Years Old Observed**	**Percent of Total Sample**
16-29	1,261	28.4%	780	14.8%
30-59	2,575	57.9%	3,353	63.8%
60+	130	2.9%	188	3.6%
Unknown	479	10.8%	933	17.8%
Total	**4,445**	**100.0%**	**5,254**	**100.0%**
Driver Race	**Number of Children 0-3 Years Old Observed**	**Percent of Total Sample**	**Number of Children 4-7 Years Old Observed**	**Percent of Total Sample**
White	3,438	77.3%	3,733	71.1%
Black	427	9.6%	553	10.5%
Other	202	4.5%	240	4.6%
Unknown	378	8.5%	728	13.9%
Total	**4,445**	**100.0%**	**5,254**	**100.0%**
Driver Belt Use	**Number of Children 0-3 Years Old Observed**	**Percent of Total Sample**	**Number of Children 4-7 Years Old Observed**	**Percent of Total Sample**
Belted	3,569	97.2%	3,799	97.4%
Not Belted	101	2.8%	101	2.6%
Total	**3,670**	**100.0%**	**3,900**	**100.0%**

4.2 Child Restraint Device Misuse Inspections

The misuse inspections were performed at 23 locations statewide between April 11 and July 15, 2015. A total of 417 inspections of the restraint devices used by child passengers under the age of 8 were performed, including 169 in the 0-1 year old age range, 142 in the 2-3 year old range, and 106 in the 4-7 year old age range. 96 inspections were performed at six sites in Stratum 1, 93 inspections at four sites in Stratum 2, 111 inspections at six sites in Stratum 3, and 117 inspections at seven sites in Stratum 4. Table 6 summarizes the descriptive statistics regarding the inspection locations by stratum, day of the week, and type of site. Table 7 summarizes the inspection percentages based on vehicle type, type of restraint, position of the child in the vehicle, and age of child.

Table 6. Summary of Misuse Inspections by Strata, Day of Week, and Type of Site

Stratum	No. of Sites	Pct. of Sites	No. of Inspections	Pct. of Inspections
Stratum 1	6	26.1%	96	23.0%
Stratum 2	4	17.4%	93	22.3%
Stratum 3	6	26.1%	111	26.6%
Stratum 4	7	30.4%	117	28.1%
Total	**23**	**100.0%**	**417**	**100.0%**
Day of the Week	**No. of Sites**	**Pct. of Sites**	**No. of Inspections**	**Pct. of Inspections**
Sunday	1	4.3%	18	4.3%
Monday	1	4.3%	12	2.9%
Tuesday	2	8.7%	42	10.1%
Wednesday	5	21.7%	95	22.8%
Thursday	4	17.4%	91	21.8%
Friday	4	17.4%	83	19.9%
Saturday	6	26.1%	76	18.2%
Total	**23**	**100.0%**	**417**	**100.0%**
Type of Site	**No. of Sites**	**Pct. of Sites**	**No. of Inspections**	**Pct. of Inspections**
Shopping Center	1	4.3%	10	2.4%
Day Care Center	7	30.4%	152	36.5%
Community, Church, or Corporate Event	7	30.4%	124	29.7%
Permanent Inspection Station	5	21.7%	63	15.1%
Health Care Center or Hospital	3	13.0%	68	16.3%
Total	**23**	**100.0%**	**417**	**100.0%**

Table 7. Summary of Misuse Inspections by Vehicle Type, CRD Type, Position in Vehicle, and Child Age

Vehicle Type	No. of Inspections	Pct. of Inspections
Passenger Car	157	37.6%
Sport Utility Vehicle	164	39.3%
Van/Minivan	78	18.7%
Pick-up Truck	18	4.4%
Total	**417**	**100.0%**
Type of Restraint	**No. of Inspections**	**Pct. of Inspections**
Rear-Facing CRD	132	31.6%
Forward-Facing CRD	185	44.4%
Belt Positioning Booster	100	24.0%
Total	**417**	**100.0%**
Position of the Child	**No. of Inspections**	**Pct. of Inspections**
Front Passenger	0	0.0%
Second Row Left	159	38.1%
Second Row Middle	67	16.1%
Second Row Right	174	41.7%
Third Row Left	6	1.4%
Third Row Middle	3	0.7%
Third Row Right	8	1.9%
Total	**417**	**100.0%**
Age of Child	**No. of Inspections**	**Pct. of Inspections**
Less than 1 Year	79	18.9%
1 Year – Less than 2 Years	90	21.6%
2 Years – Less than 3 Years	70	16.8%
3 Years – Less than 4 Years	72	17.3%
4 Years – Less than 5 Years	45	10.8%
5 Years – Less than 6 Years	36	8.6%
6 Years – Less than 7 Years	18	4.3%
7 Years – Less than 8 Years	7	1.7%
Total	**417**	**100.0%**

5.0 RESULTS

5.1 Statewide and Stratum-Level Child Restraint Device Use Rates

The statewide child restraint device use rates were calculated based upon the procedure described in the previous section for the 9,541 children for which restraint use could be determined. The CRD use rates displayed in Table 8 represent the weighted statewide percentages of 0 to 3 year old children seated in rear-facing or forward facing seats and of 4 to 7 year old children seated in rear-facing, forward facing, or booster seats. The weighted statewide child restraint use rates were 95.7 percent for 0 to 3 year-old children and 49.7 percent for 4 to 7 year-old children. The 0 to 3 year-old use rate represents a 2.1 percent increase over the 93.6 percent use rate observed during the 2013 survey [*7*]. Further, the 49.7 percent use rate for 4 to 7 year olds represents a 7.3 percent increase over the 42.4 percent use rate observed during the 2013 survey [*7*].

Table 8. Statewide Rate of Appropriate Child Restraint Device Use, by Age Group

Age Group	CRD Use Rate*	Standard Error
0-to-3 years old	95.7% ± 0.46%	0.24%
4-to-7 years old	49.7% ± 1.24%	0.63%

*Use rate based on 0 to 3 year old children seated in rear-facing or forward facing seats and 4 to 7 year old children seated in rear-facing, forward facing, or booster seats.

Table 9 displays the proportional breakdown of observations by seat type. When examining each of the specific restrain types, 27.5 percent of 0 to 3 year-old children were restrained in rear-facing child safety seats and 68.2 percent were in forward-facing safety seats. Among 4 to 7 year-olds, approximately 8.2 percent of children were restrained in front-facing child safety seats, 26.6 percent were observed in high-back boosters, and 13.7 percent were in backless boosters as shown in Table 9. The percentage of children ages 0 to 3 traveling completely unrestrained was 1.4 percent, while the percentage of unrestrained children among 4 to 7 year-olds was 5.9 percent. Most concerning was the 45.3 percent of 4 to 7 year olds that were restrained using only the safety belt.

Table 9. Restraint Use Proportions, by Child Age Group and Seat Type

Age Group	Rear-Facing CRD	Forward-Facing CRD	High Back Booster	Backless Booster	Safety Belt Only	Not Restrained
Ages 0-to-3	27.5%	68.2%	0.9%	0.4%	1.6%	1.4%
Ages 4-to-7	0.3%	8.2%	26.6%	13.7%	45.3%	5.9%
OVERALL Ages 0-to-7	**12.9%**	**36.1%**	**14.7%**	**7.5%**	**25.0%**	**3.8%**

When examining child restraint device use by stratum, the use rates among 0 to 3 year-olds ranged from 93.8 percent in Stratum 2 to 97.2 percent in Stratum 1. Among 4 to 7 year-olds, the use rates were highest in Stratum 1 (53.4 percent) and lowest in Stratum 3 (45.2 percent). These results are reflected in Table 10.

Table 10. Child Restraint Device Use, by Stratum

Stratum	Age 0-3		Age 4-7	
	CRD Use Rate	Std. Error	CRD Use Rate	Std. Error
Stratum 1	97.2% ± 1.13%	0.57%	53.4% ± 6.59%	3.36%
Stratum 2	93.8% ± 2.12%	1.08%	47.9% ± 2.72%	1.39%
Stratum 3	97.0% ± 1.06%	0.54%	45.2% ± 4.06%	2.07%
Stratum 4	95.4% ± 1.99%	1.02%	50.5% ± 4.99%	2.55%

5.2 Child Restraint Device Use Rates by Location, Vehicle, and Driver Characteristics

This section provides details of the (unweighted) child restraint device use rates based upon vehicle and driver characteristics among the 9,541 children for which restraint use could be determined. Again, the CRD use rates represent the percentages of 0 to 3 year old children seated in rear-facing or forward facing seats and of 4 to 7 year old children seated in rear-facing, forward facing, or booster seats. Comparisons are provided with respect to each characteristic, as well as with respect to prior studies on child restraint device use.

Table 11 presents child restraint use rates by type of site. CRD use rates were the highest at daycare centers and recreational locations for children aged 0 to 3 and recreational locations for children aged 4 to 7. The lowest CRD use rates were observed at fast food restaurants for children aged 0 to 3 and daycare centers and fast food restaurants for children aged 4 to 7.

Table 11. Child Restraint Device Use, by Site Type

Location Type	Age 0-3 in CRD	Age 0-3 Total	Age 0-3 CRD Use Rate	Age 4-7 in CRD	Age 4-7 Total	Age 4-7 CRD Use Rate
Daycare Center	117	120	97.5%	87	187	46.5%
Recreation	241	248	97.2%	223	433	51.5%
Shopping Center	1,014	1,053	96.3%	520	1,095	47.5%
Fast Food	511	538	95.0%	271	582	46.6%
Adjacent Street	2,359	2,474	95.4%	1,394	2,811	49.6%
Total	**4,242**	**4,433**	**95.7%**	**2,495**	**5,108**	**48.8%**

Table 12 displays very little variability between the CRD use rates across vehicle types for 0 to 3 year olds. However, among 4 to 7 year olds, CRD use was clearly highest for drivers of minivans and lowest for pickup trucks. This is consistent with prior surveys that have shown pick-up truck drivers to demonstrate lower rates of appropriate child restraint use [*6,7,19*].

Table 12. Child Restraint Device Use, by Vehicle Characteristics

Vehicle Type	Age 0-3 in CRD	Age 0-3 Total	Age 0-3 CRD Use Rate	Age 4-7 in CRD	Age 4-7 Total	Age 4-7 CRD Use Rate
Passenger Car	2,270	2,373	95.7%	1,102	2,561	43.0%
Sport Utility Vehicle	1,221	1,280	95.4%	759	1,416	53.6%
Van/Minivan	630	654	96.3%	519	836	62.1%
Pickup Truck	121	126	96.0%	115	295	39.0%
Total	**4,242**	**4,433**	**95.7%**	**2,495**	**5,108**	**48.8%**
Child Passenger Seating Position	**Age 0-3 in CRD**	**Age 0-3 Total**	**Age 0-3 CRD Use Rate**	**Age 4-7 in CRD**	**Age 4-7 Total**	**Age 4-7 CRD Use Rate**
First Row - Left	1	1	100.0%	1	1	100.0%
First Row - Center	3	3	100.0%	0	13	0.0%
First Row - Right	18	27	66.7%	30	321	9.3%
Second Row - Left	1,448	1,535	94.3%	945	1,777	53.2%
Second Row - Center	965	999	96.6%	272	595	45.7%
Second Row - Right	1,790	1,851	96.7%	1,222	2,335	52.3%
Third Row - Left	6	6	100.0%	13	23	56.5%
Third Row - Center	6	6	100.0%	2	10	20.0%
Third Row – Right	5	5	100.0%	10	33	30.3%
Total	**4,242**	**4,433**	**95.7%**	**2,495**	**5,108**	**48.8%**

Table 13 displays the rate of child restraint device use by various driver characteristics. The use rates within both child age groups were slightly higher among male drivers as compared to female drivers, although these differences were not practically significant. Analysis by driver age group showed little distinction in CRD use rates for 0 to 3 year-old passengers, although drivers over the age of 60 were less likely to appropriately restrain 4 to 7 year-olds (although it should be noted that the sample size for this age category was relatively small). White drivers showed higher rates of appropriate child restraint use, while black drivers displayed the lowest use rates, particularly for 4 to 7 year olds.

Finally, similar to previous CRD surveys in Michigan, child restraint device use was significantly lower when the driver was not belted appropriately. The CRD use rate for 0 to 3 year-old children in vehicles where the driver was belted was 95.7 percent, compared to 88.1 percent when the driver was not belted. Similarly, use rates among 4 to 7 year-old children were significantly higher when the driver was belted (49.4 percent compared to 32.6 percent).

Table 13. Child Restraint Device Use, by Driver Characteristics

Driver Gender	Age 0-3 in CRD	Age 0-3 Total	Age 0-3 CRD Use Rate	Age 4-7 in CRD	Age 4-7 Total	Age 4-7 CRD Use Rate
Male	1,359	1,414	96.1%	845	1,713	49.3%
Female	2,489	2,620	95.0%	1,278	2,646	48.3%
Unknown	394	399	98.7%	372	749	49.7%
Total	**4,242**	**4,433**	**95.7%**	**2,495**	**5,108**	**48.8%**
Driver Age	**Age 0-3 in CRD**	**Age 0-3 Total**	**Age 0-3 CRD Use Rate**	**Age 4-7 in CRD**	**Age 4-7 Total**	**Age 4-7 CRD Use Rate**
16-29	1,203	1,261	95.4%	372	739	50.3%
30-59	2,447	2,564	95.4%	1,580	3,257	48.5%
60+	125	130	96.2%	85	185	45.9%
Unknown	467	478	97.7%	458	927	49.4%
Total	**4,242**	**4,433**	**95.7%**	**2,495**	**5,108**	**48.8%**
Driver Race	**Age 0-3 in CRD**	**Age 0-3 Total**	**Age 0-3 CRD Use Rate**	**Age 4-7 in CRD**	**Age 4-7 Total**	**Age 4-7 CRD Use Rate**
White	3,288	3,429	95.9%	1,849	3,629	51.0%
Black	391	425	92.0%	187	525	35.6%
Other	190	202	94.1%	105	231	45.5%
Unknown	373	377	98.9%	354	723	49.0%
Total	**4,242**	**4,433**	**95.7%**	**2,495**	**5,108**	**48.8%**
Driver Restraint	**Age 0-3 in CRD**	**Age 0-3 Total**	**Age 0-3 CRD Use Rate**	**Age 4-7 in CRD**	**Age 4-7 Total**	**Age 4-7 CRD Use Rate**
Belted	3,408	3,560	95.7%	1,823	3,690	49.4%
Not Belted	89	101	88.1%	29	89	32.6%

5.3 Misuse Rates

The inspection data were utilized to compute the statewide misuse rate, as well as the misuse rate for each stratum, restraint type, and age group. As stated previously, a CRD/booster seat was considered to be "misused" if one or more of the itemized misuse characteristics was observed during the inspection. As the inspections were concerned with utilization of the seat itself, cases where no CRD or booster seat was utilized were not considered. Table 14 shows the statewide misuse rate in addition to the misuse rate broken down by CRD type (rear-facing, forward-facing, and booster seats only), age group, and stratum.

Table 14. Child Restraint Device Misuse Rates

Type of CRD	No. of Inspections	Correct Use Rate	Misuse Rate
Rear-Facing	132	18.9%	81.1%
Forward Facing	185	20.0%	80.0%
Belt Positioning Booster Seat	100	40.0%	60.0%
Age Group	**No. of Inspections**	**Correct Use Rate**	**Misuse Rate**
0 - 3	311	19.9%	80.1%
4 - 7	106	29.7%	70.3%
Stratum	**No. of Inspections**	**Correct Use Rate**	**Misuse Rate**
Stratum 1	96	26.0%	74.0%
Stratum 2	93	24.7%	75.3%
Stratum 3	111	26.1%	73.9%
Stratum 4	117	21.4%	78.6%
Statewide (Weighted)*	**417**	**26.0%**	**74.0%**

*Weighted based on seat use proportions from direct observation survey of 18.1%, 50.7%, and 31.2% for rear-facing, forward-facing, and booster seats, respectively.

Statewide, only 26.0 percent of the inspections of the restraint characteristics of children under age 8 showed utilization of the appropriate CRD, correct CRD installation, and correct restraint of the child within the CRD. The remaining 74.0 percent of the inspections showed one or more improper restraint characteristics (i.e., misuses), which represents the overall weighted statewide misuse rate for children under the age of 8. The overall misuse rate is similar to the 74.9 percent observed during the 2013 inspections. The overall misuse rate for children under 4 was 80.1 percent, which decreased to 70.3 percent for children ages 4 to 7. Only marginal differences were observed between misuse rates for the four strata. Rear-facing CRDs had an overall misuse rate of 81.1 percent, which was considerably lower than the 87.8 percent observed during 2013. However, forward facing CRDs showed slight increases in misuse, increasing from 77.2 in 2013 to 80.0 percent in 2015. As expected, the lowest observed misuse rates were for children seated in booster seats, with a misuse rate was 60.0 percent, which was similar to that observed in the 2013 inspections. Booster seats have historically had lower rates of misuse compared to rear and forward facing CRDs, which is likely due to the relative simplicity of booster seat utilization compared to the other CRDs. Itemized misuse rates were also computed based on several different characteristics of the CRD use and installation and restraint of the child within the CRD. Table 15 provides a summary of the correct and incorrect CRD selection and position percentages based on the child's age, height, weight, and orientation of the CRD within the vehicle.

Table 15. Child Restraint Device Selection and Seat Orientation Characteristics

CRD Characteristic	Percent Correct	Percent Incorrect
Restraint appropriate for child's age*	84.9%	15.1%
Restraint appropriate for child's height	91.4%	8.6%
Restraint appropriate for child's weight**	95.0%	5.0%
CRD facing proper direction for child's age/weight*,**	86.4%	13.6%
Seat intended to be used in direction installed**	97.8%	2.2%
CRD installed on a forward-facing vehicle seat	100.0%	0.0%

*Forward facing seat utilization is considered misuse for children under the age of 2. Booster seat utilization is considered misuse for children under the age of 4.
**Includes rear and forward facing CRDs only. Booster seats are not included.

Table 15 shows the CRD selection and orientation were typically appropriate for the child's age, height, and weight. These values are similar to those observed in the 2013 inspections. The most common CRD selection misuse was inappropriate seat selection based on age, due in large part to the premature transition of children between the ages of 1 and 2 into forward facing CRDs. This issue is further delineated in Table 16, which displays the types of seats utilized by each age group.

Table 16. Child Restraint Device Selection, by Age of Child

Age	Rear-Facing CRD		Forward-Facing CRD		Booster Seat	
	No.	Pct.	No.	Pct.	No.	Pct.
0	77	58.3%	**2**	**1.1%**	0	0.0%
1	48	36.4%	**41**	**22.2%**	**1**	**1.0%**
2	5	3.8%	59	31.9%	**6**	**6.0%**
3	2	1.5%	57	30.8%	**13**	**13.0%**
4	0	0.0%	17	9.2%	28	28.0%
5	0	0.0%	6	3.2%	30	30.0%
6	0	0.0%	3	1.6%	15	15.0%
7	0	0.0%	0	0.0%	7	7.0%

Note: Cases of premature transitioning into the next restraint level based on age are shown in bold

It can be observed from Table 16 that 26 percent children were prematurely transitioned into a forward-facing CRD prior to the age of 2, which is the minimum age recommended by the American Association of Pediatrics (AAP) [*22*]. This is especially problematic for 1-year old children, of which 46.7 percent were seated (prematurely) in a forward-facing CRD. Similarly, 18.1 percent of 3-year old children had been prematurely transitioned into a booster seat, which should not occur until the child has reached at least 4 years of age. Itemized booster seat misuse rates are summarized in Table 17. The remaining itemized misuse rates were separated into rear-facing CRD misuses and forward-facing CRD misuses, which are summarized in Table 18.

Table 17. Booster Seat Installation and Restraint Characteristics

Booster Seat Characteristic	Percent Correct	Percent Incorrect
Shoulder belt properly positioned over shoulder and chest	74.0%	**26.0%**
Shoulder belt flat	84.0%	16.0%
Seat belt tight	87.0%	13.0%
Proper space between booster back and vehicle seat back	88.0%	12.0%
Lap belt flat	89.0%	11.0%
3-point lap-shoulder belt used	89.0%	11.0%
Lap belt properly positioned across hips and upper thighs	93.0%	7.0%
Backless Booster: Vehicle seat back high enough to restrain child's head	96.0%	4.0%

Note: boldface indicates a common misuse (i.e., greater than 25 percent misuse). Data represents 100 booster seat inspections. Characteristics are sorted by misuse rate (highest to lowest).

Table 18. Rear-Facing and Forward-Facing CRD Installation and Restraint Characteristics

	Rear-Facing CRDs (n=132)		Forward-Facing CRDs (n=185)	
CRD Characteristic	Percent Correct	Percent Incorrect	Percent Correct	Percent Incorrect
Harness retainer clip in proper location	43.2%	**56.8%**	53.0%	**47.0%**
CRD at the proper angle	62.1%	**37.9%**	96.2%	3.8%
Shoulder harness straps route into CRD at proper height	84.1%	15.9%	69.2%	**30.8%**
CRD installation tight (1 in or less lateral sway)	81.8%	18.2%	89.7%	10.3%
Harness straps tight (1 in or less slack)	82.6%	17.4%	78.9%	21.1%
Harness straps flat	84.8%	15.2%	76.8%	23.2%
Proper belt path/LATCH connector path used	93.2%	6.8%	93.5%	6.5%
Only one vehicle system used to attach CRD	93.9%	6.1%	91.9%	8.1%
Seatbelt/LATCH properly buckled and tight	97.0%	3.0%	95.1%	4.9%
Internal harness buckled	97.7%	2.3%	94.6%	5.4%
Harness retainer clip fastened and properly oriented	97.7%	2.3%	91.9%	8.1%
Crotch strap flat	98.5%	1.5%	91.4%	8.6%
No excess space between CRD and vehicle seat	N/A	N/A	84.9%	15.1%
Tether routed properly over/under headrest	N/A	N/A	80.0%	20.0%
Tether strap tight (1 inch or less slack)	N/A	N/A	90.0%	10.0%

Note: boldface indicates a common misuse (i.e., greater than 25 percent misuse). Characteristics are sorted by misuse rate for rear-facing seats (highest to lowest).

A discussion of the itemized CRD and booster seat misuses displayed in Tables 17 and 18 is as follows:

- By far the most common misuse for both rear- and forward-facing CRDs was the improper positioning of the harness retainer clip (typically too low), which was observed in nearly 57 percent of the rear-facing seats and 47 percent of the forward-facing seats. Although low harness retainer clips have historically been a problem in prior CRD misuse inspections, the problem seems to have increased for both forward-facing, and especially rear-facing seats, since the 2013 inspections.
- Improper seat incline was also a common misuse (38% misused) for rear-facing seats, although this misuse rate was down from the 2013 inspections. In most cases, this misuse was a result of too great of a recline. The rear-facing incline should be increased from 45 degrees to 60 degrees (measured from horizontal) once the child can hold his/her head up, which typically occurs around 6 months of age. Excessive seat recline is rarely a problem for forward-facing seats.
- Improper shoulder harness routing was observed in approximately 30 percent of the forward-facing seats, which is similar to the rate observed during the 2013 inspections. In many cases, this misuse results from the harnesses being routed below the shoulders, which is likely a carry-over from rear-facing utilization of the particular seat.
- Approximately 1 in 5 of the rear-facing and forward-facing CRDs were both found to have excessive slack (greater than 1-inch) in the harness strap, although these rates have declined substantially since the 2013 inspections. A common reason given by parents for not tightening the harness properly was they did not want the harness to cause discomfort to the child – particularly for infants.
- Loose seat installation, while still common in rear-facing seats (18 percent), was much improved from the 2013 inspections for both rear- and forward-facing seats.
- Excess space between the CRD and the vehicle seat-back remains a common problem (15 percent) for forward-facing seats; although this misuse rate had declined from the 2013 surveys.
- Twisted harness straps (or twisted seat belts for booster seats) were observed in approximately 1 in 5 cases, which increased slightly from the 2013 inspections.
- The most common misuse for booster seats was improper positioning of the shoulder belt over the shoulder, collar bone, and chest, which was observed in 1 in 4 inspections.

5.4 Risk Priority Values for CRD Misuses

The risk priority values for the rear-facing CRDs and forward-facing CRDs were calculated as described earlier in this report and are shown in Tables 19 and 20, respectively. As shown in these tables, the rear-facing CRD misuses resulted in an average risk priority number per CRD of 4.57. The forward-facing CRDs average risk priority number of 3.89 was slightly lower than for rear-facing CRDs, a trend that is consistent with prior CRD inspections. A risk priority number of 4.0 and above indicates a negative impact on the protective capabilities of the CRD during an automobile crash. Thus, the average risk priority numbers for rear-facing CRDs (and very nearly for forward-facing CRDs) indicate that a majority of the CRDs inspected have protective capabilities that may be compromised if involved in an automobile crash. However, for both rear-facing and forward-facing CRDs, the risk priority values have declined since the 2013 interviews.

Table 19. Rear-Facing CRD Severity Scores, Percent Occurrence, and Risk Priority

Rear-Facing CRD Misuse	Severity Score [*8,9*]	Percent Occurrence	Risk Priority Number
CRD was reclined at improper angle	3	37.90%	113.70
Harness retainer clip was too low	2	54.50%	109.00
Shoulder harness straps routed too high	6.3	15.90%	100.17
Seatbelt routed incorrectly	9	6.80%	61.20
Harness too loose (≥4 fingers)	6.7	8.30%	55.61
Shoulder harness straps were twisted	2.7	15.20%	41.04
Harness too loose (3 fingers)	4.3	9.10%	39.13
Harness too loose (2 fingers)	1.7	13.60%	23.12
Internal harness was not buckled	10	2.30%	23.00
Seatbelt/LATCH was not buckled	7	3.00%	21.00
Harness retainer clip was too high	2.5	2.30%	5.75
Harness retainer clip was not attached	2.3	2.30%	5.29
Crotch strap was twisted	3.5	1.50%	5.25
Average Risk Priority Number per Rear-Facing CRD (n=132)			**4.57**

Table 20. Forward-Facing CRD Severity Scores, Percent Occurrence, and Risk Priority

Forward-Facing CRD Misuse	Severity Score [*8,9*]	Percent Occurrence	Risk Priority Number
Tether routed incorrectly	9	20.00%	180.00
Harness too loose (≥4 fingers)	6.3	13.50%	85.05
Shoulder harness straps routed too low	2.3	30.80%	70.84
Harness retainer clip was too low	1.5	40.00%	60.00
Internal harness was not buckled	10	5.40%	54.00
Shoulder harness straps were twisted	1.3	23.20%	30.16
Crotch strap was twisted	3.5	8.60%	30.10
Seatbelt/LATCH was not buckled	6	4.90%	29.40
Harness too loose (3 fingers)	3.7	7.60%	28.12
Space between CRD and vehicle seat 1”	2	13.50%	27.00
Space between CRD and vehicle seat 4”	6	4.30%	25.80
Space between CRD and vehicle seat 3”	5	4.90%	24.50
Space between CRD and vehicle seat 2”	4	5.90%	23.60
CRD was reclined at improper angle	4.6	3.80%	17.48
Harness retainer clip was not attached	2	8.10%	16.20
Harness retainer clip was too high	2.5	3.80%	9.50
Harness too loose (2 fingers)	1.3	6.50%	8.45
Shoulder harness straps were too high	1.7	0.00%	0.00
Average Risk Priority Number per Forward-Facing CRD (n=185)			**3.89**

In addition to providing a relative comparison between the severity of misuses between the rear-facing CRDs and forward facing CRDs, these tables also show the types of misuse that should be emphasized on correcting based on the risk priority number. The most problematic misuses for rear- and forward-facing seats are as follows:

- Rear-Facing CRDs
  - Excessive seat recline. This almost exclusively relates to children older than approximately 6 months. At this age, children typically become able to hold up his/her head, at which point the incline from horizontal should be increased from 45 degrees to approximately 60 degrees. Although this is a relatively low-severity misuse, it does occur at a relatively high frequency, which drove the risk priority number upward.

- Harness retainer clip too low. Although the severity score is relatively low, this was by far the most frequent misuse for both rear-facing and forward-facing CRDs.
- Shoulder harness straps routed too high. This is the most severe of the higher risk rear-facing misuses, although the rate of occurrence is relatively low. Shoulder harness straps in rear-facing seats should be routed at or below the child's shoulders to help prevent ejection from the seat.
- Seatbelt routed incorrectly. Incorrect routing of the seat belt through the seat is a very high severity misuse, which was observed in nearly 7 percent of rear-facing CRDs.

- Forward-Facing CRDs
  - Improper routing of top tether. The most problematic misuse for forward-facing CRDs was the improper routing of the top tether with respect to the vehicle headrest. This is both a severe and common misuse. The top tether should be routed over a fixed headrest and under a movable headrest.
  - Excessive harness slack. Another problematic forward-facing CRD misuse was excessive harness slack. The severity of this misuse obviously becomes greater as the harness loosens. An improperly tightened harness may potentially allow for the child to eject from the CRD in the event of a crash.
  - Shoulder harness straps routed too low. Shoulder harness straps should be at or above the shoulders for forward-facing CRDs. Although this was a relatively low severity misuse, it was common.
  - Harness retainer clip positioned too low. A low harness retainer clip may allow for the child to be ejected from the CRD in the event of a crash. This was also a relatively low severity misuse, but was the most common forward-facing CRD misuse.
  - Internal harness was not buckled. Alarmingly, the internal harnesses were not buckled in approximately 1 in 20 forward-facing CRDs. Not buckling of the internal harness creates a high likelihood of ejection in the event of a crash.

5.5 LATCH Utilization

The observers also noted whether or not the LATCH system was available within the vehicle and, if so, whether or not the LATCH anchors were being utilized to restrain the CRD. Table 21 presents data on utilization of the LATCH system obtained from the inspections.

Table 21. LATCH Availability and Utilization

CRD Type	Pct. of Vehicles Equipped with LATCH	Pct. of Equipped Vehicles Using LATCH	Pct. of All Vehicles Using LATCH
Rear-Facing	93.7%	41.5%	38.9%
Forward-Facing	88.7%	31.2%	27.7%
Total	**90.8%**	**35.6%**	**32.3%**

The LATCH system was utilized to secure the CRD in 32.3 of the inspected vehicles, even though 90.8 percent of all inspected vehicles were LATCH equipped. Although they greatly simplify the CRD attachment process,

LATCH was utilized in only 35.6 percent of equipped vehicles. The percent of vehicles equipped with LATCH has increased greatly from the 75.4 percent observed during the 2013 inspections, while the percent of LATCH utilization among equipped vehicles has declined.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to determine the statewide rates of appropriate child restraint device use and misuse among child passengers from ages 0 through 7. The child restraint use rates were determined through a direct observation survey conducted at daycare centers, fast food restaurants, shopping centers, recreational areas, and general roadside locations throughout the state of Michigan. Misuse rates were determined through in-vehicle inspections conducted at daycare centers, inspection stations, and various organized events, including those held at shopping centers, community or church festivals, or health care facilities.

6.1 Conclusions

6.1.1 CRD/Booster Utilization

The statewide child restraint device roadside direct observation survey was performed between Saturday, May 9, 2015 and Wednesday, July 29, 2015. During this observation period, a total of 9,699 observations of 0 to 7 year-old child passengers were conducted at daycare centers, fast food restaurants, shopping centers, and recreation centers, as well as on streets adjacent to these locations throughout the 23-county sample.

The direct observation survey showed children ages 0 to 3 were seated in a rear or forward facing CRD in 95.7 percent of the statewide observations, and children ages 4 to 7 were restrained in a rear or forward facing CRD or booster seat in 49.7 percent of the statewide observations. These usage rates have increased from prior surveys conducted in 2009, 2011, and 2013, especially for 4 to 7 year olds, which is reflected in Table 22. It should be noted that Michigan's current child restraint and booster seat law was enacted in 2008.

Table 22. Statewide Rates of Appropriate Child Restraint Device Use, by Year

	CRD Use Rate by Year*			
Age Group	**2009/2010**	**2011**	**2013**	**2015**
0-to-3 years old	94.9%	95.0%	93.6%	95.7%
4-to-7 years old	44.5%	43.9%	42.4%	49.7%

*Use rate based on 0 to 3 year old children seated in rear-facing or forward facing seats and 4 to 7 year old children seated in rear-facing, forward facing, or booster seats.

Several conclusions were drawn regarding CRD and booster seat utilization, which are summarized as follows:

- CRD use rates were the highest at daycare centers and recreational locations for children aged 0 to 3 and recreational locations for children aged 4 to 7. The lowest CRD use rates were observed at fast food restaurants for children aged 0 to 3 and daycare centers and fast food restaurants for children aged 4 to 7.
- Among 4 to 7 year olds, CRD use was highest for minivans and lowest for pickup trucks. Very little variability between the CRD use rates was observed across vehicle types for 0 to 3 year olds.
- Little difference in CRD use was observed between male and female drivers.

- Little difference in CRD use was observed across the various driver age groups for 0 to 3 year olds, although drivers over the age of 60 were less likely to use an appropriate restraint for 4 to 7 year-olds.
- White drivers showed the highest CRD use rates for both 0 to 3 and 4 to 7 year olds, while black drivers showed the lowest rates, particularly for 4 to 7 year olds.
- Similar to previous CRD surveys in Michigan, the most significant driver-related determinant of CRD or booster seat use among child passengers was driver belt use. CRD/booster use was significantly lower when the driver was not belted appropriately. The CRD use rate for 0 to 3 year-old children in vehicles where the driver was belted was 95.7 percent, compared to 88.1 percent among cases where the driver was not belted. Similarly, use rates among 4 to 7 year-old children were significantly higher when drivers were belted (49.4 percent vs. 32.6 percent). These findings are consistent with those from Doyle and Levitt [*23*], which show unrestrained children are generally found with riskier drivers, including those who are less likely to be properly restrained and more likely to be crash-involved.

6.1.2 CRD/Booster Misuse

The misuse inspections were performed at 23 locations statewide between April 11 and July 15, 2015. A total of 417 inspections of the restraint devices used by child passengers under the age of 8 were performed, including 169 in the 0-1 year old age range, 142 in the 2-3 year old range, and 106 in the 4-7 year old age range.

Statewide, only 26.0 percent of the inspections of the restraint characteristics of children under age 8 showed utilization of the appropriate CRD, correct CRD installation, and correct restraint of the child within the CRD. The remaining 74.0 percent of the inspections showed one or more improper restraint characteristics (i.e., misuses), which represents the overall weighted statewide misuse rate for children under the age of 8. The overall misuse rate is similar to those found during the 2011 and 2013 inspections, which were 73.9 percent and 74.9 percent, respectively. Comparison between the misuse rates from the prior three CRD/booster seat inspections are displayed in Table 23. In general, since 2011, rear facing seats have seen an overall decline in misuse, while forward facing seats have seen an overall increase in misuse. Booster seat misuse rates have remained consistent during that time. .

Table 23. Statewide Rates of Child Restraint Device Misuse, by Year

	Misuse Use Rate by Year		
Age Group	**2011**	**2013**	**2015**
Rear-Facing CRD	86.1%	87.8%	81.1%
Forward-Facing CRD	75.8%	77.2%	80.0%
Booster Seat	60.2%	58.7%	60.0%
OVERALL	73.9%*	74.9%*	74.0%**

*Unweighted

** Weighted based on seat use proportions from direct observation survey

Several conclusions were also drawn regarding common CRD/booster misuses, which are summarized as follows:

- Nearly 47 percent of 1-year old children were (prematurely) seated in a forward-facing CRD, which the AAP recommends should not occur until the age of 2.
- Similarly, 18 percent of 3-year old children were prematurely transitioned into a booster seat, which should not occur until the child has reached at least 4 years of age.
- The most common seat-related misuse for both rear- and forward-facing CRDs was the improper positioning of the harness retainer clip (typically too low), which was observed in nearly 57 percent of the rear-facing seats and 47 percent of the forward-facing seats.
- Excessive recline (from vertical) was also a common misuse for rear-facing seats. The seat incline should be increased from 45 degrees to 60 degrees (from horizontal) when an infant is able to lift his/her head.
- Improper harness routing below the shoulders was a common problem for forward-facing seats, which is likely a carry-over from rear-facing utilization of the particular seat.
- Excessive slack (greater than 1-inch) in the harness strap remains a common misuse for both rear- and forward-facing seats, although these rates have declined substantially from prior inspections. A common reason given by parents for not tightening the harness properly was they did not want the harness to cause discomfort to the child – particularly for infants.
- Loose seat installation, while still common in rear-facing seats, was much improved from prior inspections for both rear- and forward-facing seats.
- Excess space between the CRD and the vehicle seat-back remains a common problem for forward-facing seats; although this misuse rate had declined from the prior inspections.
- Twisted harness straps (twisted seat belts for booster seats) had increased slightly from prior surveys.
- The most common misuse for booster seats was improper positioning of the shoulder belt over the shoulder, collar bone, and chest.
- The LATCH system continues to be underutilized. Despite the presence of LATCH in more than 90 percent of the inspected vehicles, the system was found to be utilized in only 35.6 percent of equipped vehicles.

In terms of risk-priority number [*8,9*], the following conclusions were drawn from the misuse inspections:

- For both rear-facing and forward-facing CRDs, the risk priority values have declined since the 2013 interviews. However, the average risk priority numbers for rear-facing CRDs (and very nearly for forward-facing CRDs) indicate that a majority of the CRDs inspected have protective capabilities that may be compromised if involved in an automobile crash.
- Consistent with prior inspections, rear-facing seats had a greater risk priority number than forward-facing.
- From a risk priority standpoint, the most problematic rear-facing seat misuses are as follows:
    - Excessive seat recline
    - Harness retainer clip too low
    - Shoulder harness straps routed too high
    - Seatbelt routed incorrectly
- From a risk priority standpoint, the most problematic forward-facing seat misuses are as follows:
    - Improper routing of top tether

- Excessive harness slack
- Shoulder harness straps routed too low
- Harness retainer clop positioned too low
- Internal harness not buckles

6.2 Recommendations

To ensure proper CRD and booster seat use, parents must be provided with child restraint education and training periodically throughout their child's growth and development, particularly when a new CRD is utilized or modification to the current CRD becomes necessary. For example, the installation of a CRD for a newborn is drastically different than for a 3 year-old child. The following age/development stages often necessitate a new CRD or modification to the current CRD:

- Birth (first use of CRD, which must be rear facing with a 45 degree incline)
- Between 6 and 12 months of age (switch from infant carrier to larger rear-facing CRD and increase in the incline from 45 to 60 degrees from horizontal when the child is able to lift his/her head)
- Age 24 months (switch from rear-facing CRD to forward-facing CRD, which requires re-routing of the harness straps and seat belt path, among other changes)
- Age 4 and 40 pounds (switch to booster seat)
- Age 8 or 4'9" tall (switch to safety belt in rear vehicle seat until age 13)

Parents should also be encouraged to follow the current NHTSA CRD transitioning guidelines, which advise keeping children in each restraint type, including rear-facing, forward-facing and booster seats, for as long as possible before moving them up to the next type of restraint [*24*]. Particular emphasis should be placed on educating parents as to the appropriate timing for 1.) transitioning from a 45 to 60 degree incline, 2.) transitioning from rear-facing to forward-facing, and 3.) transitioning from forward-facing CRD to booster seat. The rear-facing position reduces stresses to the neck and spine to infants and reduces the likelihood of severe injury during a crash. With the AAP's March 2011 increase in the recommended minimum age for transitioning from rear to forward facing from one year to two years of age [*22*], it is likely many parents are not yet aware of this increase. Similarly, forward-facing seat utilization should be emphasized until the child outgrows the seat (or the seat expires), due to the inherent safety benefits compared to booster seats.

The most significant driver-related determinant of CRD or booster seat use among child passengers was driver belt use. CRD/booster use was significantly lower when the driver was not belted appropriately. Unbelted drivers present the greatest area of opportunity and should be the focus of future education and outreach programs aimed at informing the public of the importance of appropriate child restraint device use. Similar programs have proven particularly effective at increasing safety belt use among Michigan drivers.

Several educational/training opportunities are available to parents. Hospitals typically provide basic hands-on training of CRD and booster seat installation and use for parents of newborns upon discharge from the hospital. Day care facilities often provide basic child restraint education, but do not have the staff to provide full inspection or training. There are many locations throughout the State of Michigan where parents can have their CRD or booster seat inspected by certified individuals. NHTSA-certified inspectors are often available at most fire stations and police stations, although appointments may be required. The non-profit organization SafeKids USA sponsors several CRD/booster seat inspection/training events statewide. These events have one or more NHTSA certified inspectors on-site to inspect the CRD installation and inform the parents if they are using an incorrect restraint for their child or if the device has been recalled. The inspectors will also show the parents how to properly install the CRD/booster seat in the vehicle and how to properly restrain the child in the seat. Parents should be encouraged to have their CRD/booster seat inspected by a NHTSA-certified inspector anytime a new CRD/booster is utilized, a change to the existing installation or internal restraint is needed, or after the child has experienced substantial growth or development. Parents should also be informed of the benefits of the LATCH system, which simplifies correct attachment of the CRD to the vehicle. The current LATCH utilization survey suggests great underutilization of the LATCH system, despite its presence in greater than 90 percent of the inspected vehicles.

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APPENDIX I – LIST OF DAYCARE CENTERS OBSERVED BY STRATUM

Stratum	County	Location Name	Address
1	Ingham	Happy Elephant Child Care	4010 W Michigan Ave, Lansing, MI 48917
1	Kalamazoo	Child Development Center	6325 Oakland Dr, Portage, MI 49024
1	Oakland	Gingellville Early Childhood Center	4375 S Baldwin Rd, Orion Charter Township, MI 48359
1	Oakland	Great Beginnings Day Care Center	35912 12 Mile Rd, Farmington Hills, MI 48331
1	Oakland	The Learning Experience	5660 New King Dr, Troy, MI 48098
1	Oakland	Northville First Care	777 W 8 Mile Rd, Northville, MI 48167
1	Oakland	ToddlerTime	15705 W 10 Mile Rd, Southfield, MI 48075
1	Oakland	Whitney Bloomfield Learning Center	4500 Arline Dr, West Bloomfield Township, MI 48323
2	Kent	Alphabet Soup Daycare Center	1708 Leonard St NE, Grand Rapids, MI 49505
2	Kent	Appletree Learning Center	1953 Monroe Ave NW, Grand Rapids, MI 49505
2	Kent	Appletree Learning Center	2142 3 Mile Rd NW, Grand Rapids, MI 49544
2	Kent	Mayfair Christian Daycare	1738 Lyon St NE, Grand Rapids, MI 49503
2	Midland	Kids 1st Development Center	1621 E Wheeler St, Midland, MI 48642
2	Ottawa	Cottonwood Day Care	1101 Cypress Dr, Jenison, MI 49428
2	Ottawa	Daily Shepherd Child Care	1481 Baldwin St, Jenison, MI 49428
3	Genesee	Grand Akidemy Development Center	10811 S Saginaw St, Grand Blanc, MI 48439
3	Genesee	Little Peoples Playhouse	6218 Kids Ln, Flushing, MI 48433
3	Saginaw	St. Stephen Day Care	1320 Malzahn St, Saginaw, MI 48602
3	St. Clair	Kids Connection	301 N 6th St, Marysville, MI 48079
3	St. Clair	Marysville Children's Center	901 Michigan Ave, Marysville, MI 48040
3	St. Clair	Marysville Co-Op Preschool	1341 11th St, Marysville, MI 48040
4	Wayne	Dearborn Christian Daycare	922 Beech-Daly Rd, Dearborn Heights, MI 48127
4	Wayne	Dreamy Children's Center	27335 W Warren St, Dearborn Heights, MI 48127
4	Wayne	Nanny's Nursery School	9529 Pardee Rd, Taylor, MI 48180
4	Wayne	Nanny's Nursery School	21085 Goddard Rd, Taylor, MI 48180
4	Wayne	Rainbow Childcare Center	16200 Hubbard Dr, Dearborn, MI 48126
4	Wayne	Tutor Time	951 N Canton Center Rd, Canton, MI 48187
4	Wayne	Tutor Time	15225 N Haggerty Rd, Plymouth, MI 48170

APPENDIX II – LIST OF FAST FOOD RESTAURANTS, SHOPPING CENTERS, AND RECREATIONAL SITES OBSERVED BY STRATUM

Stratum	County	Location Name	Address
1	Ingham	Burger King	523 S Waverly Rd, Lansing, MI 48917
1	Ingham	Eastwood Towne Center	3003 Preyde Blvd, Lansing, MI 48912
1	Ingham	Family Aquatic Center	6400 Abbot Rd, East Lansing, MI 48823
1	Ingham	Hawk Island County Park	1601 E Cavanaugh Rd, Lansing, MI 48910
1	Ingham	Lansing Mall	5662 W Saginaw Hwy, Lansing, MI 48917
1	Ingham	McDonald's	4015 W Saginaw Hwy, Lansing, MI 48917
1	Ingham	Meridian Mall	1982 W Grand River Ave, Meridian Charter Township, MI 48864
1	Ingham	Potter Park Zoo	1301 S Pennsylvania Ave, Lansing, MI 48912
1	Ingham	Walmart	409 N Marketplace Blvd, Lansing, MI 48917
1	Ingham	Walmart	3225 Towne Centre Blvd, Lansing Charter Township, MI 48912
1	Ingham	Wendy's	3621 S Martin Luther King Blvd, Lansing, MI 48910
1	Ingham	Wendy's	3920 W Saginaw Hwy, Lansing, MI 48917
1	Kalamazoo	Cross Roads Mall	6650 S Westnedge Ave, Portage, MI 49024
1	Kalamazoo	Harding's Marketplace	5161 W Main St, Kalamazoo, MI 49009
1	Kalamazoo	McDonald's	5394 W Main St, Kalamazoo, MI 49009
1	Kalamazoo	McDonald's	6925 S Westnedge Ave, Portage, MI 49002
1	Kalamazoo	McDonald's	8050 Portage Rd, Portage, MI 49002
1	Kalamazoo	Meijer	5800 Gull Rd, Kalamazoo Township, MI 49048
1	Oakland	Babies R Us	20111 Haggerty Rd, Northville, MI 48167
1	Oakland	Chipotle	6753 Orchard Lake Rd, West Bloomfield Township, MI 48322
1	Oakland	Detroit Zoo	8450 W 10 Mile Rd, Royal Oak, MI 48067
1	Oakland	Great Lakes Crossing	4000 Baldwin Road, Auburn Hills, MI 48326
1	Oakland	High Point Shopping Center	20901 Haggerty Rd, Novi, MI 48375
1	Oakland	Kendallwood Shopping	33340 W 12 Mile Rd, Farmington Hills, MI 48334
1	Oakland	Kroger	4395 Orchard Lake Rd, West Bloomfield Township, MI 48323
1	Oakland	McDonald's	3950 Baldwin Road, Auburn Hills, MI 48326
1	Oakland	McDonald's	4819 N Rochester Rd, Troy, MI 48085
1	Oakland	McDonald's	21050 Haggerty Rd, Novi, MI 48375
1	Oakland	McDonald's	26550 Greenfield Rd, Oak Park, MI 48237
1	Oakland	McDonald's	31325 Orchard Lake Rd, Farmington Hills, MI 48334
1	Oakland	McDonald's	37555 12 Mile Rd, Farmington Hills, MI 48331
1	Oakland	Meijer	1703 Haggerty Rd, Commerce Township, MI 48396
1	Oakland	Northville Village Shopping Center	17101 Haggerty Rd, Northville, MI 48168
1	Oakland	On The Border	21091 Haggerty Rd, Novi, MI 48375
1	Oakland	Orchard Mall	6445 Orchard Lake Rd, West Bloomfield Township, MI 48322
1	Oakland	Sealife Aquarium	4316 Baldwin Rd, Auburn Hills, MI 48326
1	Oakland	Target	20100 Haggerty Rd, Novi, MI 48375
1	Washtenaw	Ann Arbor Children's Museum	220 E Ann St, Ann Arbor, MI 48104

1	Washtenaw	Arborland Shopping Center	3600 Washtenaw Ave, Ann Arbor, MI 48104
1	Washtenaw	Briarwood Mall	100 Briarwood Cir, Ann Arbor, MI 48108
1	Washtenaw	Burger King	725 Victors Way, Ann Arbor, MI 48108
1	Washtenaw	Denny’s	3310 Washtenaw Ave, Ann Arbor, MI 48104
1	Washtenaw	McDonald’s	3325 Washtenaw Ave, Ann Arbor, MI

Stratum	County	Location Name	Address
2	Allegan	McDonald's	1218 Allegan St, Plainwell, MI 49080
2	Allegan	Meijer	1195 Allegan St, Plainwell, MI 49080
2	Calhoun	McDonald's	81 W Columbia Ave, Battle Creek, MI 49015
2	Calhoun	Walmart	6020 B Dr N, Battle Creek, MI 49014
2	Eaton	Burger King	214 Lansing Rd, Charlotte, MI 48813
2	Eaton	McDonald's	207 Lansing St, Charlotte, MI 48813
2	Eaton	Meijer	1167 E Clinton Trail, Charlotte, MI 48813
2	Eaton	Walmart	1680 Packard Hwy, Charlotte, MI 48813
2	Grand Traverse	Grand Traverse Mall	3200 W S Airport Rd, Traverse City, MI 49684
2	Grand Traverse	Kohl's	3333 US 31, Traverse City, MI 49684
2	Grand Traverse	McDonald's	3606 US-31, Traverse City, MI 49684
2	Grand Traverse	Meijer	3955 S US 31, Traverse City, MI 49684
2	Jackson	McDonald's	3310 E Michigan Ave, Jackson, MI 49202
2	Jackson	Meijer	2777 Airport Rd, Jackson, MI 49202
2	Kent	Applebee's	4488 Potomac Ave SW, Grandville, MI 49418
2	Kent	Green Ridge Square	3298 Alpine Dr NW, Grand Rapids, MI 49544
2	Kent	McDonald's	2652 Alpine Ave NW, Grand Rapids, MI 49544
2	Kent	McDonald's	2980 44th St SW, Grandville, MI 49418
2	Kent	McDonald's	3814 Plainfield Ave NE, Grand Rapids, MI 49525
2	Kent	Meijer	2425 Alpine Ave NW, Grand Rapids, MI 49544
2	Kent	Meijer	3434 Century Center Dr SW, Grandville, MI 49418
2	Kent	Meijer	3757 Plainfield Ave NE, Grand Rapids, MI 49525
2	Kent	RiverTown Crossings	3700 Rivertown Pkwy, Grandville, MI 49418
2	Kent	Salvation Army	4160 Plainfield Ave NE, Grand Rapids, MI 49525
2	Kent	Taco Bell	3243 Plainfield Ave, Grand Rapids, MI 49525
2	Kent	Walmart	4542 Kenowa Ave SW, Grandville, MI 49418
2	Kent	Wendy's	2315 Alpine Ave NW, Grand Rapids, MI 49509
2	Livingston	Kensington Park	13160 Highridge Dr, Brighton, MI 48114
2	Livingston	McDonald's	1360 N Burkhart Rd, Howell, MI 48855
2	Livingston	Meijer	3883 E Grand River Ave, Howell, MI 48843
2	Livingston	Meijer	8650 W Grand River Ave, Brighton, MI 48116
2	Livingston	Tanger Outlets	1475 N Burkhart Rd, Howell, MI 48855
2	Livingston	Walmart	3850 E Grand River Ave, Howell, MI 48843
2	Midland	Burger King	6730 Eastman Ave, Midland, MI 48642
2	Midland	McDonald's	1711 S Saginaw Rd, Midland, MI 48640
2	Midland	Midland Mall	6820 Eastman Ave, Midland, MI 48642
2	Monroe	Burger King	1566 N Telegraph Rd, Monroe, MI 48162
2	Monroe	McDonald's	1533 N Telegraph Rd, Monroe, MI 48162
2	Monroe	Meijer	1700 N Telegraph Rd, Monroe, MI 48162
2	Monroe	Sterling State Park	2800 State Park Rd, Monroe, MI 48162

2	Monroe	T.J.Maxx	2339 N Telegraph Rd, Monroe, MI 48162
2	Ottawa	Culver's	7393 Cottonwood Dr, Jenison, MI 49428
2	Ottawa	Family Fare Supermarket	1965 Baldwin St, Jenison, MI 49428
2	Ottawa	McDonald's	160 Chicago Dr, Jenison, MI 49428
2	Ottawa	Meijer	550 Baldwin St, Georgetown Township, MI 49428

Stratum	County	Location Name	Address
3	Berrien	Burger King	2035 Scottdale Rd, Benton Harbor, MI 49022
3	Berrien	Target	960 Fairplain Dr, Benton Harbor, MI 49022
3	Berrien	Walmart	1400 Mall Dr, Benton Harbor, MI 49022
3	Berrien	Wendy's	1986 Scottdale Rd, Benton Harbor, MI 49022
3	Genesee	Burger King	11325 S Saginaw Street, Grand Blanc, MI 48439
3	Genesee	Flint Children's Museum	1602 University Ave, Flint, MI 48504
3	Genesee	Lincor Park	2095 Linden Rd, Flint, MI 48532
3	Genesee	McDonald's	2145 Linden Rd, Flint, MI 48532
3	Genesee	McDonald's	4131 W Pierson Rd, Flint, MI 48504
3	Genesee	Toys R Us	3250 S Linden Rd, Flint, MI 48507
3	Genesee	Walmart	4313 Corunna Rd, Flint, MI 48532
3	Genesee	Walmart	6170 S Saginaw Rd, Grand Blanc, MI 48439
3	Genesee	Wendy's	4314 Corunna Rd, Flint, MI 48532
3	Isabella	McDonald's	1804 S Mission St, Mt Pleasant, MI 48858
3	Isabella	Walmart	4730 Encore Dr, Mt Pleasant, MI 48858
3	Muskegon	Lakes Mall	5600 Harvey St, Muskegon, MI 49444
3	Muskegon	McDonald's	1779 E Sherman Blvd, Muskegon, MI 49444
3	Muskegon	Meijer	5326 S Harvey St, Muskegon, MI 49444
3	Muskegon	Michigan Adventure	4750 Whitehall Rd, Muskegon, MI 49445
3	Muskegon	Westshore Plaza	1979 E Sherman Blvd, Muskegon, MI 49444
3	Saginaw	Burger King	4930 State St, Saginaw, MI 48603
3	Saginaw	Fashion Square Mall	4787 Fashion Square Mall, Saginaw, MI 48604
3	Saginaw	McDonald's	2930 Tittabawassee Rd, Saginaw, MI 48604
3	Saginaw	McDonald's	5008 State St, Saginaw, MI 48603
3	Saginaw	Meijer	3413 Tittabawassee Rd, Saginaw, MI 48604
3	St. Clair	Burger King	3100 Gratiot Blvd, Marysville, MI 48040
3	St. Clair	Kentucky Fried Chicken	1501 Gratiot Blvd, Marysville, MI 48040
3	St. Clair	Marysville Municipal Park	801 Huron Blvd, Marysville, MI 48040
3	St. Clair	Marysville Plaza	3200 Gratiot Blvd, Marysville, MI 48040
3	St. Clair	McDonald's	1925 Gratiot Blvd, Marysville, MI 48040
3	St. Clair	Meijer	205 S Range Rd, Marysville, MI 48040
3	St. Clair	Rite Aid Pharmacy	1750 Gratiot Blvd, Marysville, MI 48040
3	St. Clair	Wally's Supermarket	3200 Gratiot Blvd, Marysville, MI 48040
3	Van Buren	South Beach Park	1555 Phoenix St, South Haven, MI 49090
3	Van Buren	Wendy's	3383 73rd St, South Haven, MI 49090

Stratum	County	Location Name	Address
4	Macomb	Lake St. Clair Metropark	31300 Metro Pkwy, Harrison Charter Township, MI 48045
4	Macomb	Lakeside Mall	14000 Lakeside Cir, Sterling Heights, MI 48313
4	Macomb	McDonald's	13640 Southcove Dr, Sterling Heights, MI 48313
4	Macomb	McDonald's	47475 Van Dyke Ave, Utica, MI 48317
4	Macomb	Stony Creek Metropark	4300 Main Park Dr, Shelby Charter Township, MI 48316
4	Macomb	Universal Mall	28582 Dequindre Rd, Warren, MI 48092
4	Wayne	BuyBuy Baby	42595 Ford Rd, Canton, MI 48187
4	Wayne	CVS	25762 Van Born Rd, Dearborn Heights, MI 48125
4	Wayne	Greenfield Village	20900 Oakwood Blvd, Dearborn, MI 48124
4	Wayne	Henry Ford IMAX Theater	20900 Oakwood Blvd, Dearborn, MI 48124
4	Wayne	Kroger	23000 Michigan Ave, Dearborn, MI 48124
4	Wayne	Kroger	23303 Michigan Ave, Dearborn, MI 48124
4	Wayne	McDonald's	4145 S Telegraph Rd, Dearborn Heights, MI 48125
4	Wayne	McDonald's	13158 Ford Rd, Dearborn, MI 48126
4	Wayne	McDonald's	18787 Northline Rd, Southgate, MI 48195
4	Wayne	McDonald's	19311 Farmington Rd, Livonia, MI 48152
4	Wayne	McDonald's	23333 Eureka Rd, Taylor, MI 48180
4	Wayne	McDonald's	39700 5 Mile Rd, Plymouth, MI 48170
4	Wayne	McDonald's	44900 Ford Rd, Canton, MI 48187
4	Wayne	McDonald's	45510 Michigan Ave, Canton, MI 48188
4	Wayne	Meijer	3565 Fairlane Dr, Allen Park, MI 48101
4	Wayne	Meijer	14640 Pardee Rd, Taylor, MI 48180
4	Wayne	Meijer	45001 Ford Rd, Canton, MI 48187
4	Wayne	Panera	22208 Michigan Ave, Dearborn, MI 48124
4	Wayne	Pizza Hut	44995 Ford Rd, Canton, MI 48187
4	Wayne	Southland Center Mall	23000 Eureka Rd, Taylor, MI 48180
4	Wayne	Subway	23229 W Outer Dr, Allen Park, MI 48101
4	Wayne	Taco Bell	25120 Michigan Ave, Dearborn, MI 48124
4	Wayne	Target	43670 Ford Rd, Canton, MI 48187
4	Wayne	Walgreens	5709 S Telegraph Rd, Dearborn Heights, MI 48125
4	Wayne	Walmart	5851 Mercury Dr, Dearborn, MI 48126
4	Wayne	Walmart	29574 7 Mile Rd, Livonia, MI 48152
4	Wayne	Wendy's	8515 N Telegraph Rd, Dearborn Heights, MI 48127

APPENDIX III – LIST OF INSPECTION LOCATIONS

Strata	County	Date	Location	Address
1	Oakland	4/25/2015	Bartlett Elementary	350 School St, South Lyon, MI 48178
1	Oakland	5/18/2015	Chrysler Museum	1 Chrysler Dr, Auburn Hills, MI 44836
1	Oakland	6/06/2015	LOC Credit Union	22981 Farmington Rd, Farmington, MI 48336
1	Oakland	6/11/2015	Northville First Care	777 W 8 Mile Rd, Northville, MI 48167
1	Oakland	6/24/2015	Whitney Bloomfield Learning Center	4500 Arline Dr, West Bloomfield Township, MI 48323
1	Washtenaw	4/15/2015	Ypsilanti Fire Station	222 S Ford Blvd, Ypsilanti, MI 48198
2	Grand Traverse	5/22/2015	Grand Traverse Metro Fire Station	3000 Albany St, Traverse City, MI 49684
2	Jackson	5/21/2015	Allegiance Health Jackson	205 N East Ave, Jackson, MI 49201
2	Jackson	6/12/2015	Jackson County Fairgrounds	200 W Ganson St, Jackson, MI 49201
2	Kent	5/28/2015	Grand Rapids Fire Station	2541 Kalamazoo Ave SE, Grand Rapids, MI 49507
3	Clare	4/18/2015	Farwell Area Schools	399 E Michigan St, Farwell, MI 48622
3	Hillsdale	6/17/2015	Hillsdale County Fairgrounds	115 S Broad St, Hillsdale, MI 49242
3	Lenawee	5/16/2015	Sukhi's Party Store	4938 S Meridian Rd, Hudson, MI 49247
3	Sanilac	6/12/2015	Sandusky Fire Station	163 South Elk St, Sandusky, MI 48471
3	St. Clair	6/02/2015	Kids Connection	301 N 6th St, St Clair, MI 48079
3	St. Clair	6/04/2015	Marysville Children's Center	901 Michigan Ave, Marysville, MI 48040
4	Macomb	4/11/2015	BuyBuy Baby	13361 Hall Rd, Utica, MI 48315
4	Macomb	5/03/2015	Chesterfield Fire Station	33991 23 Mile Rd, Chesterfield, MI 48047
4	Macomb	6/23/2015	Macomb Montessori Academy	14057 E 9 Mile Rd, Warren, MI 48089
4	Macomb	7/08/2015	Beaumont Hospital	15979 Hall Rd, Macomb, MI 48044
4	Wayne	6/06/2015	DMC	4700 W Fort St, Detroit, MI 48209
4	Wayne	7/10/2015	Nanny's Nursery School	9529 Pardee Rd, Taylor, MI 48180
4	Wayne	7/15/2015	Nanny's Nursery School	21085 Goddard Rd, Taylor, MI 48180

CHILD RESTRAINT DEVICES INTERVIEW FORM (for child occupants under the age of 8)

Vehicle #: _____ **Date:** ____/ ____ / 20 ____ **Time of Day:** _____ am / pm **Weather:** _____ **Observer's Name:** _____

Location Name: _____ **Address:** _____

Instructions: Use one form for each child occupant age 7 and under. Complete page 1 first. Complete the second page for children seated in a CRD or BPB.

Vehicle Type: 1 Passenger car 2 SUV 3 Van/minivan 4 Pick-up truck

Make: _____ **Model:** _____ **Year:** _____

Is Vehicle LATCH Equipped? 1 Yes 2 No

Restrained Child Seating Position (circle number where child is seated):

	First Row	Second Row	Third Row	
Front of Vehicle	3	6	9	Cargo Area
	2	5	8	
	D	4	7	

Other Children Seating Position (circle numbers where children under age of 12 were seated):

	First Row	Second Row	Third Row	
Front of Vehicle	3	6	9	Cargo Area
	2	5	8	
	D	4	7	

Age (fill in): _____ yrs OR _____ (mo if < 2 yr)

Weight (fill in): _____ lbs

Height: _____ (feet or inches, please indicate)

Driver Age (Approx.): ❑ 16 - 29 ❑ 30 - 59 ❑ 60+

Driver Gender: ❑ Male ❑ Female

Driver Race: ❑ Caucasian ❑ African American ❑ Asian or Pacific Islander ❑ Hispanic ❑ Native American

Restraint:
1 Rear-Facing CRD
2 Forward-Facing CRD
3 Belt Positioning Boosters (BPB)
4 Seat Belt (Stop the observation now)
5 Unrestrained (Stop the observation now)

Restraint Device Selection and Child Position:

1. Is CRD appropriate for child's height? 1 Yes 2 No

Rear Facing: Head must not be less than 1 inch from top edge of CRD

Forward Facing: 1) Top of the ears must not reach the top of the CRD & 2) Shoulders must not be above the top harness slots

All Boosters: Seat belt must cross at shoulders and not across neck or face

Backless Booster: 1) Vehicle seat back must be higher than child's ears or 2) the vehicle seat must have a head restraint.

2. Please record the maximum weight limit displayed on the seat: _____lbs

3. Is the seat an infant carrier? 1 Yes 2 No

4. Is CRD intended to be used in the direction it is installed? 1 Yes 2 No

5. Is CRD installed on a forward-facing vehicle seat? 1 Yes 2 No

For Children Seated in Front Seats Only:

6. Does the vehicle have a passenger airbag? 1 Yes 2 No

7. If there is an airbag, is it turned off? 1 Yes 2 No 3 Don't Know

8. If the airbag is on, is the child at least 12" away from the airbag? 1 Yes 2 No 3 Don't Know

9. If the airbag is on, is the child facing forward? 1 Yes 2 No 3 Don't Know

FOR FRONT-FACING CRDs

Position/Installation in Vehicle

1. Is the seat reclined properly (upright against the seat back)? — 1 Yes 2 No
2. Is the CRD installation tight (1-inch rule when checked at base of seat)? — 1 Yes 2 No
3. What is the maximum space between the CRD and the vehicle seat back? — 0 inches 1 inch 2 inches 3 inches ≥4 inches

Harness

4. Is internal CRD harness completely buckled at the waist? — 1 Yes 2 No

IF BUCKLED:

(a) How tight are the shoulder harness straps (pinch and fingers)? — 0 No slack when pinched 1 finger 2 fingers 3 fingers ≥4 fingers

(b) Is the harness retainer clip fastened and orientated correctly? — 1 Yes 2 No 3 No Clip

(c) Where is the harness retainer clip positioned when buckled? — 1 Proper (at armpit level) 2 Too high 3 Too low

(d) Where do the shoulder harness straps rout into the CRD? — 1 Proper (at or above shoulders) 2 Too high (above ears) 3 Too low (below shoulders)

(e) Are the shoulder harness straps flat (not twisted)? — 1 Yes 2 No

(f) Is crotch strap flat (check if buckle button is facing outward)? — 1 Yes 2 No

Locking/Attachment

5. Which vehicle system is used to attach CRD to the vehicle? — 1 SB 2 Lower LATCH Anchors 3 Both 4 None

IF ATTACHED:

(a) Is vehicle seatbelt securing CRD buckled or LATCH straps clipped to anchors? — 1 Yes 2 No

(b) If the vehicle seatbelt is used, is the seatbelt locked? (pull on lap belt) — 1 Yes 2 No

(c) Is the vehicle seatbelt or LATCH strap flat (not twisted)? — 1 Yes 2 No

(d) Is the proper seatbelt path or LATCH strap connector path used (path nearest the vehicle's seat)? — 1 Yes 2 No

(e) If a metal locking clip is used, is it positioned near the buckle? — 1 Yes 2 No 3 Not Used

Tether (Only If Used)

6. Is the tether routed under an adjustable head restraint or over a non-adjustable head restraint? — 1 Yes 2 No
7. Is tether strap flat (not more than one twist)? — 1 Yes 2 No
8. When pinched, how much slack is in the tether strap (in inches)? — 0 inches 1 inch 2 inches 3 inches 4 inches ≥5 inches

FOR REAR-FACING CRDs

Position/Installation in Vehicle

1. What is the seat incline (estimated from horizontal)? — 1 ~45° 2 ~60° 3 <35° 4 >70°
2. Is the CRD installation tight (1-inch rule when checked at base of seat)? — 1 Yes 2 No

Harness

3. Is internal CRD harness completely buckled at the waist? — 1 Yes 2 No

IF BUCKLED:

(a) How tight are the shoulder harness straps (pinch and fingers)? — 0 No slack when pinched 1 finger 2 fingers 3 fingers ≥4 fingers

(b) Is the harness retainer clip attached and orientated correctly? — 1 Yes 2 No

(c) Where is the harness retainer clip positioned when buckled? — 1 Proper (at armpit level) 2 Too high 3 Too low

(d) Where do the shoulder harness straps rout into the CRD? — 1 Proper (at or below shoulders) 2 Too high (above shoulders)

(e) Are the shoulder harness straps flat (not twisted)? — 1 Yes 2 No

(f) Is crotch strap flat (check if buckle button is facing outward)? — 1 Yes 2 No

Locking/Attachment

4. Which vehicle system is used to attach CRD to the vehicle? — 1 SB 2 Lower LATCH Anchors 3 Both 4 Neither

IF ATTACHED:

(a) Is vehicle seatbelt securing CRD buckled or LATCH straps clipped to anchors? — 1 Yes 2 No

(b) If the vehicle seatbelt is used, is the seatbelt locked (pull on lap belt)? — 1 Yes 2 No

(c) Is vehicle seatbelt or LATCH strap flat (not twisted)? — 1 Yes 2 No

(d) Is the proper vehicle seatbelt path/lower strap connector path used (path nearest the vehicle's seat)? — 1 Yes 2 No

(e) If a metal locking clip is used, is it positioned near the buckle? — 1 Yes 2 No 3 Not Used

FOR BOOSTER SEATS (BPB)

Vehicle Seatbelt

1. Is a proper lap and shoulder belt (3-point) system used? — 1 Yes 2 No
2. Is the shoulder belt properly positioned over shoulder, collar bone, & chest? — 1 Yes 2 No
3. Is the lap belt properly positioned across the hips/upper thighs? — 1 Yes 2 No
4. Is the shoulder belt flat (not twisted)? — 1 Yes 2 No
5. Is the lap belt flat (not twisted)? — 1 Yes 2 No
6. Is the seat belt tight (not loose)? — 1 Yes 2 No
7. *HIGH BACK ONLY:* Is vehicle seatbelt routed properly through the booster seat? — 1 Yes 2 No

Position in Vehicle

8. If a backless BPB is being used, is the vehicle seat back high enough to restrain the child's head (vehicle seat back reaches child's ear height)? — 1 Yes 2 No 3 High-back BPB
9. What is the space between the BPB back and vehicle seat back (in inches)? — 0 in 1 in 2 in 3 in ≥4 in